Muskoka

THE

ONTARIO WATER RESOURCES

COMMISSION

STATUS OF ENRICHMENT

of

WALKER'S LAKE

LAKE OF BAYS

1971

STATUS OF ENRICHMENT

OF

WALKER'S LAKE

TOWNSHIP OF

LAKE OF BAYS

1971

by

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Biology Branch

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SUMMARY AND RECOMMENDATIONS

Critical reducing conditions in Walker's Lake were evinced by oxygen and pH depletions in the bottom waters as well as higher phosphorus, nitrogen, iron, silica, bicarbonate and free CO_2 levels in the deeper strata than in the epilimnion. A potential iron-phosphorus re-cycling nutrient mechanism was apparent in the water layer immediately above bottom. Oxygen concentrations were highest while CO_2 levels were lowest in the mid-thermocline and upper hypolimnion. The low standing stocks of phytoplankton were indicative of a low productivity lake. Definite indications of eutrophy were not detected.

Since the current biological and chemical status of Walker's Lake is critical and as more evidence is appearing which demonstrates that phosphorus inputs from septic tank-tile field systems produce eutrophication problems, development of Walker's Lake should not be considered unless it can be conclusively demonstrated that the sewage facilities provided will not undermine future water quality. Facilities provided should prevent organic wastes, bacteria and/or nutrients from gaining access to the Lake.

The use of washing compounds containing phosphates should be avoided by local residents. Most household liquid dishwashing products do not contain phosphates and so do not contribute to feeding algae. If clothes

washing is carried out at summer cottages on the lake, it is not necessary to use granular detergents containing phosphates, since ordinary soap products perform adequately in water from soft-water lakes. Although the phosphate content of all household detergents have been reduced to approximately 20% as P_2O_5 (effective August, 1970), the exclusive use of laundry soaps would provide a significant reduction in the potential enrichment by phosphates.

It is imperative that research be conducted into alternatives for, or modifications to, septic tank-tile field systems where these cannot be expected to function adequately. In addition, new concepts in sub-division planning should be considered for recreational lakes. For example, clusters of cottages are an alternative to the traditional idea of lots surrounding a waterfront. Such summer homes would be well removed from the lake with access to individual lots gained via cul-de-sacs designed to discourage through traffic. "Cluster-cottaging" would be more amenable to sewage facilities and at the same time would maintain the uniqueness and aesthetics of the natural shoreline.

INTRODUCTION

The consultant firm of Bird and Hale (Airphoto Interpretation Studies, Engineering and Environmental Co-ordination) completed a study in July, 1971 to assess the potential effects on the quality of the environment of a proposed new sub-division on Walker's Lake.

The report recommended that 39 lots of the 111 proposed should not be built upon and that fill should be imported in all areas where development is to occur. Mr. G.A. Missingham, P. Eng., District Engineer requested that a survey be carried out to evaluate the current status of enrichment of the lake to more fully appreciate how critical it would be if leachate from septic tank-tile field systems eventually gained access to the lake.

Subsequently, personnel of the Biology Branch carried out a survey on August 17, 1971 to document the biological, chemical and limnological conditions of Walker's Lake and to comment on possible effects of future artificial enrichment.

GENERAL DESCRIPTION OF THE STUDY AREA

Walker's Lake is located in the Township of Lake of Bays, approximately 8 miles northeast of Huntsville (Figure 1) and 146 miles from Toronto. The lake, a head-water of the Muskoka Lakes system is fed primarily by two intermittently flowing streams and a number of springs in the lake floor (Hale and Bird, 1971). In addition, watershed runoff, ground water infiltration and rainfall contributes to the lake's inflow. A single stream draining

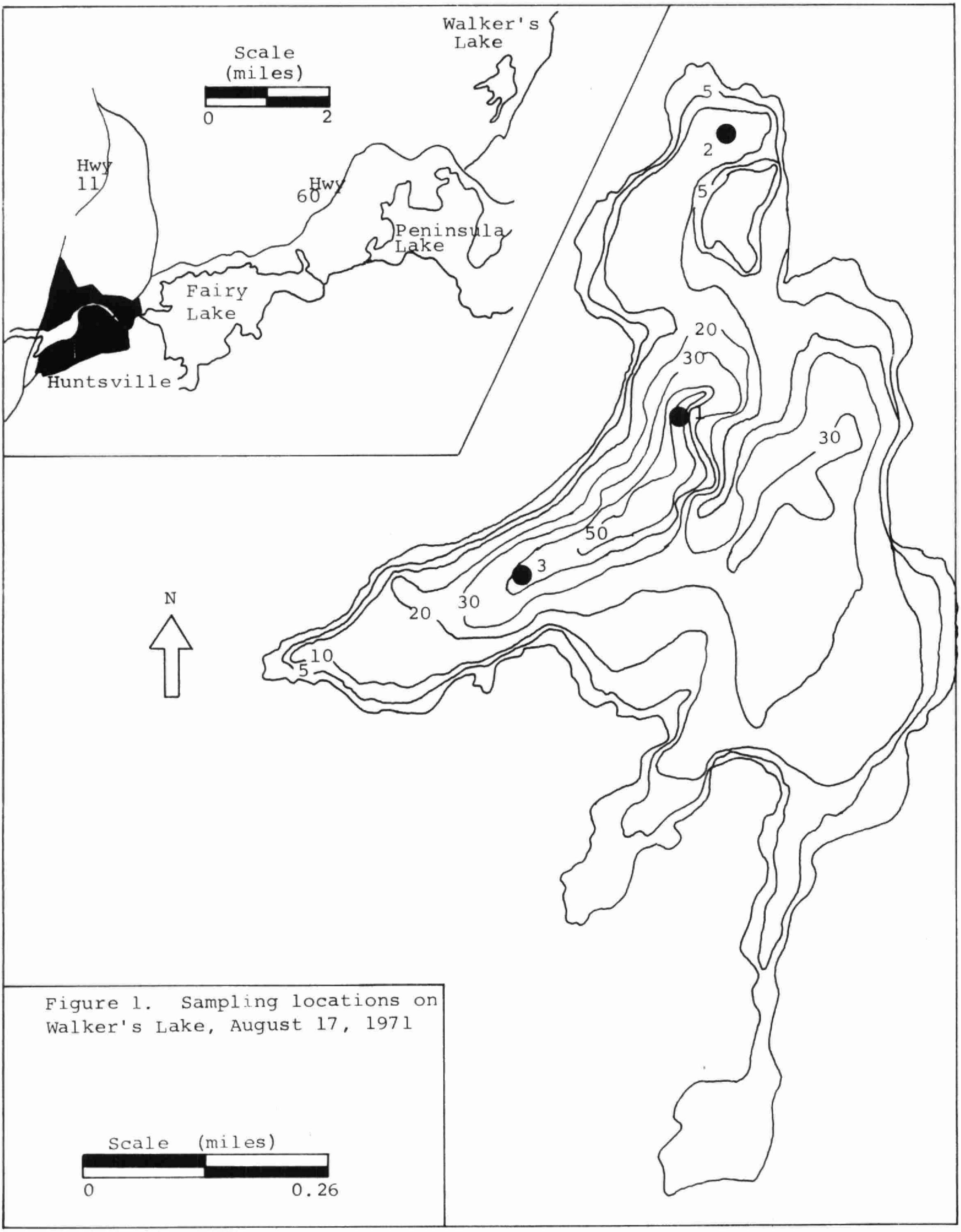

Figure 1. Sampling locations on Walker's Lake, August 17, 1971

from the south end of the lake to Peninsula Lake accommodates an approximate outflow volume of 1,155 acre feet over a 5½ month period (Hale and Bird, 1971).

Various physical characteristics of the lake are tabulated below

Maximum depth	-	50 feet
Mean depth	-	15.9 feet
Length	-	5,700 feet
Width	-	3,720 feet
Volume	-	2,929.8 acre feet
Surface Area	-	185 acres
Drainage area	-	815 acres
Length of shoreline		21,600 feet

Walker's Lake is situated in the Pre-Cambrian Shield region of Ontario in impervious, weathered bedrock of metamorphic origin. Hale and Bird (1971) point out that the rock is characterized by "....fractures and faults which provide aquifers for the movement of groundwater." A relatively silty, well-drained, thin overburden which exists throughout much of the proposed sub-division rarely exceeds 4 feet of depth, especially in the steeper, weathered area; however, occasional deeper pockets (8-10 feet) were encountered with a soil auger in a number of gently sloping and/or flat areas.

An estimated 15-20 cottages currently exist along the eastern shore of the lake. Cottagers have been informed that a 111 lot lakeshore sub-division has been proposed although Bird and Hale (1971) indicate that 39 of the lots were completely unsuitable for development and

imported fill must be acquired for septic tank-tile field beds for the remaining 72 lots.

METHODS

Field methods

Physical measurements and biological and chemical samplings were made on August 17, 1971 at three stations in Walker's Lake (Figure 1). Considering the three stations, more detailed recordings were made at Station 1, a location which approximated the deepest section (50 feet) of the lake.

Temperature readings were made every foot of depth using a telethermometer while an index of light penetration was made with a Secchi disc. Dissolved oxygen profiles were established using the Winkler method. The addition of manganese sulphate, alkalide azide and sulphuric acid re-agents and titration with 0.0045 N sodium thiosulphate solution was carried out in the field. In addition, measurements for pH, alkalinity, and free CO_2 were acquired from a number of depths at each station. The necessary analytical procedures for determining pH, alkalinity and free CO_2 (i.e. for alkalinity, titration with 0.002 N H_2SO_4 until a pH end point of 4.3 was reached) were completed in the field.

At Station 1 only, chemical (including chlorophyll) and biological samples were taken from eight depths (surface, 10,18 23, 26,30 37 and 47 feet) to 47 feet using a Van Dorn water sampler. Chlorophyll samples were preserved with

1 ml. of a 2% solution of magnesium carbonate. Samples obtained for identification and enumeration of algae were preserved with Lugol's Iodine at the time of sampling. At Station 2 and 3, the aforementioned samples were not taken. Chemical and chlorophyll samples were kept cool during transit and were processed immediately upon arrival at the OWRC Laboratories in Toronto.

Laboratory Methods

Nutrient analyses were performed on each water sample collected at Station 1 for total and soluble phosphorus (as P), total Kjeldahl, free ammonia, nitrate and nitrite nitrogen (as N) and orthosilicate (as SiO_2). Also, determinations for iron (as Fe) were completed. All analyses were performed according to procedures outlined in Standard Methods (A.P.H.A. *et al.*1965). Chlorophyll determinations were completed following the method of Brydges (1971).

The algal samples were concentrated by allowing the cells to settle for 72-96 hours, and then syphoning the overlying liquid. Subsequently, the cells were re-suspended and a 1-ml aliquot was pipetted into a Sedgwick-Rafter counting cell. All of the algal forms were identified to species where possible and to genus otherwise at a magnification of 200X. Numerical results were recorded as areal standard units (a.s.u.) per millilitre. One areal standard unit is equal to an area of 400 square microns (Whipple 1914). The areal value was employed because of its usefulness in measuring standing stocks of

algae and because it is extremely useful when relating algal levels to water quality problems. Depending upon the density of the concentrate, strips or fields were counted. To render results statistically accurate, between 150 and 200 organisms per millilitre were identified and measured.

RESULTS

Physical aspects

Temperature

On August 17, a well-defined thermocline or zone of rapid temperature change was detected at Stations 1 and 3 commencing at 19 feet (Figure 2a and c). On this date, the thermocline was characterized by a drop of 11 ^{o}C in 11 feet. At Station 2, water temperatures were uniform from the surface (21.6 ^{o}C) to the bottom (Figure 2b).

Light Penetration

Secchi disc readings of 21.7 and 19.8 feet at Station 1 and 3, respectively indicated a euphotic zone or zone of algal production to a depth approximating 40 feet. At Station 2, the Secchi disc was visible to the lake bottom (16.5 feet).

Water Chemistry

Alkalinity, pH and free CO_2

Moyle (1949) considered a total alkalinity of 40 mg/l to be a natural separation point between soft

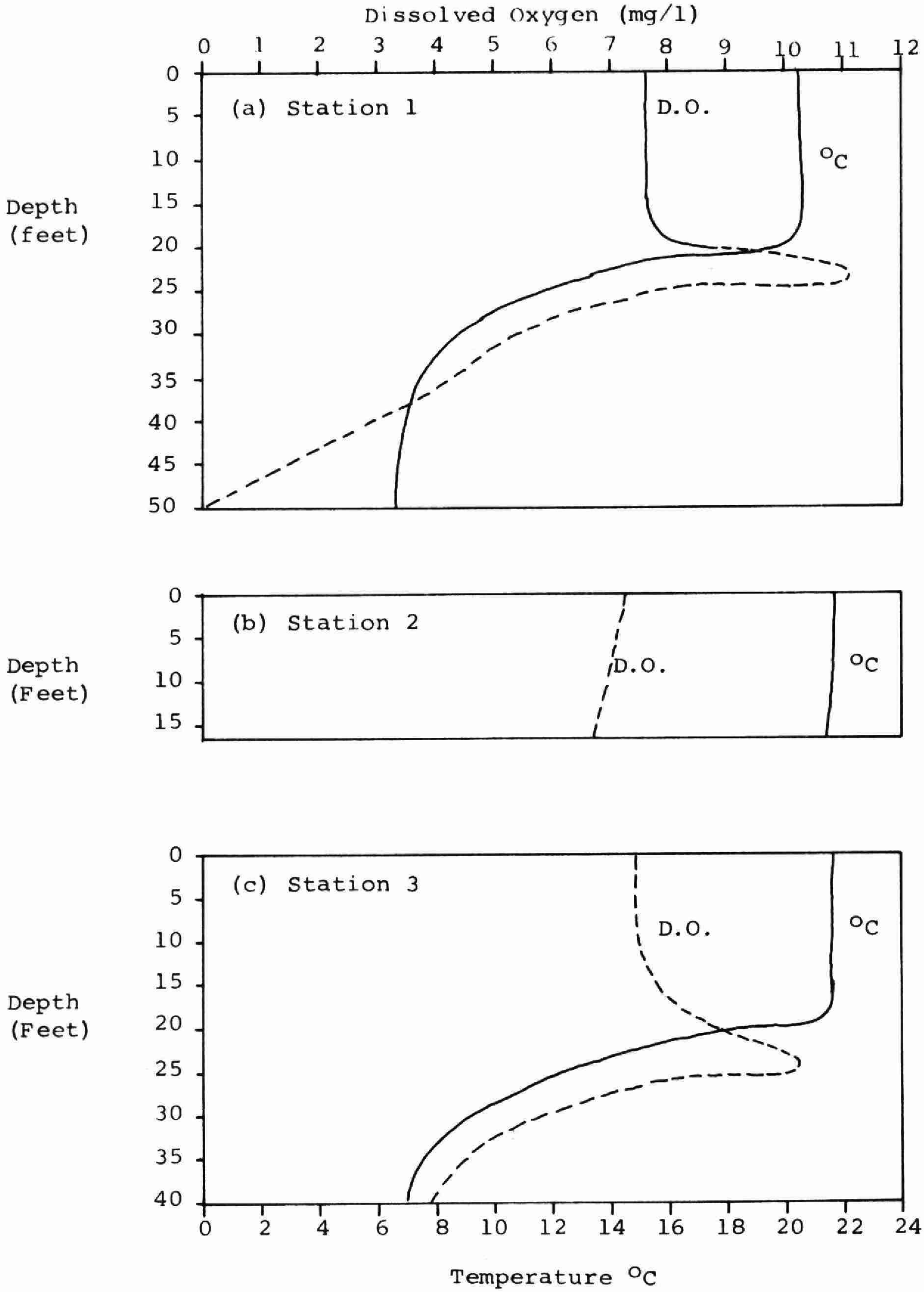

Figure 2. Profiles of dissolved oxygen and temperature at three Stations in Walker's Lake, August 17, 1971.

and hard waters. Walker's Lake was characterized by a mean alkalinity of 20 mg/l. At the two deep-water stations (i.e. Station 1 and 3), slight increases in alkalinity were detected; for example, at Station 1 alkalinity values at 1, 18, 23, 26, 37 and 47 feet were 28, 29, 29, 29, 30 and 35 mg/l, respectively.

Without exception, the pH was higher in the surface waters than in the deeper strata at all stations (Figures 3a, b and c), although the highest pH values were found in the metalimnion. For instance, at Station 1, readings at 1, 18, 23, 26, 37 and 47 feet were 6.3, 6.3, 6.8, 6.5, 5.8 and 5.8, respectively. Free CO_2 concentrations showed an inverse relationship to dissolved oxygen (Figure 3a, b and c). This is defined as a negative heterograde CO_2 distribution.

Dissolved oxygen

Striking maxima in oxygen saturations were apparent between the mid-thermocline and the upper hypolimnion (Figure 2a and c). For example, at 23 feet at Station 1, an oxygen saturation of 105% or 10.9 mg/l was found. At Station 2 (Figure 2b) oxygen saturations were non-diminishing with depth.

Nutrient considerations

Total and soluble phosphorus as well as total Kjeldahl, free ammonia, nitrate and nitrite nitrogen in the hypolimnion (zone of colder water below the stable thermocline) were considerably higher than those recorded from the warmer epilimnetic (above-thermocline) waters (Figure 4a, b and c). At this point it is significant to note that iron concentrations

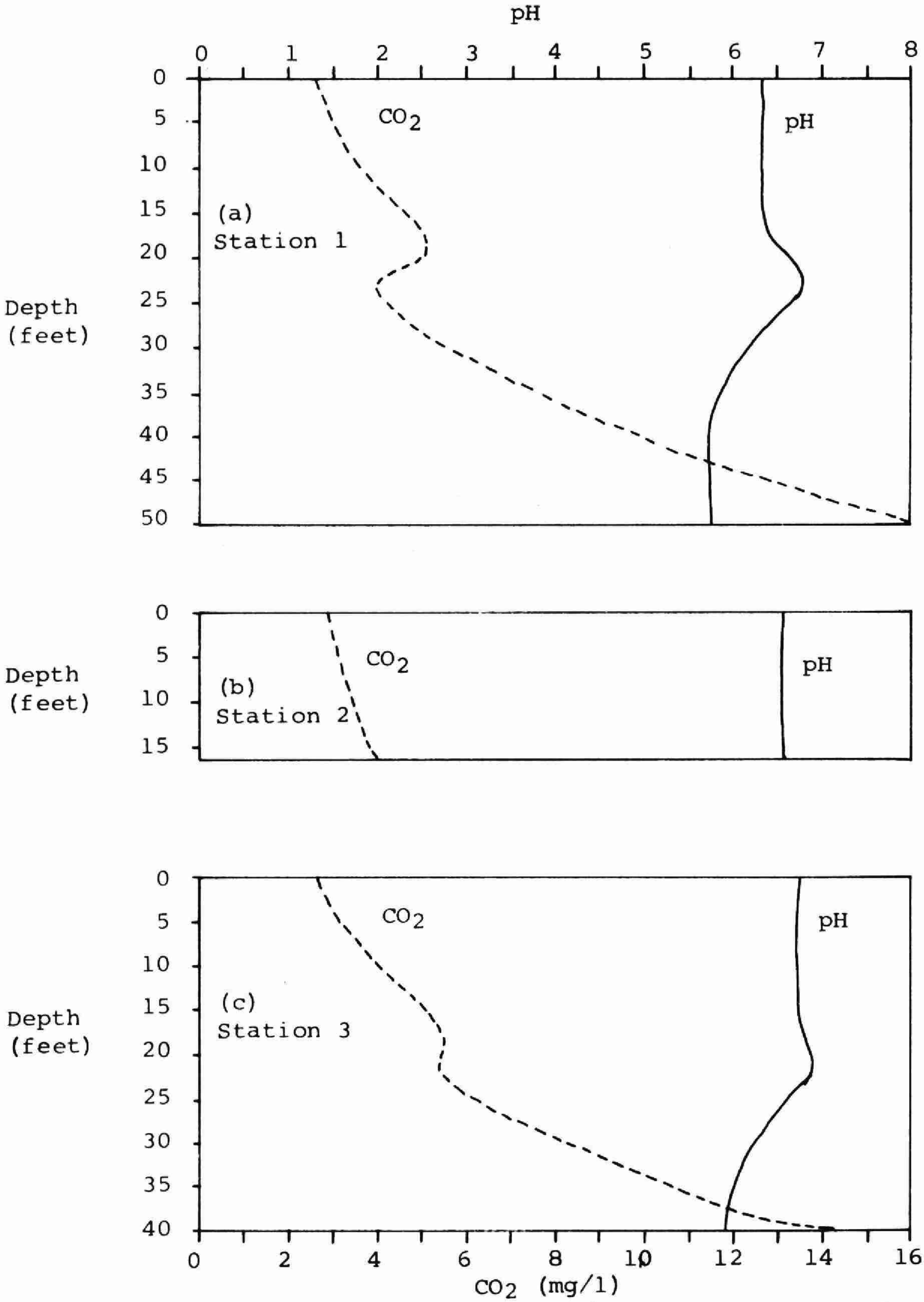

Figure 3. Profiles of free CO_2 (mg/l) and pH at three locations in Walker's Lake, August 17, 1971.

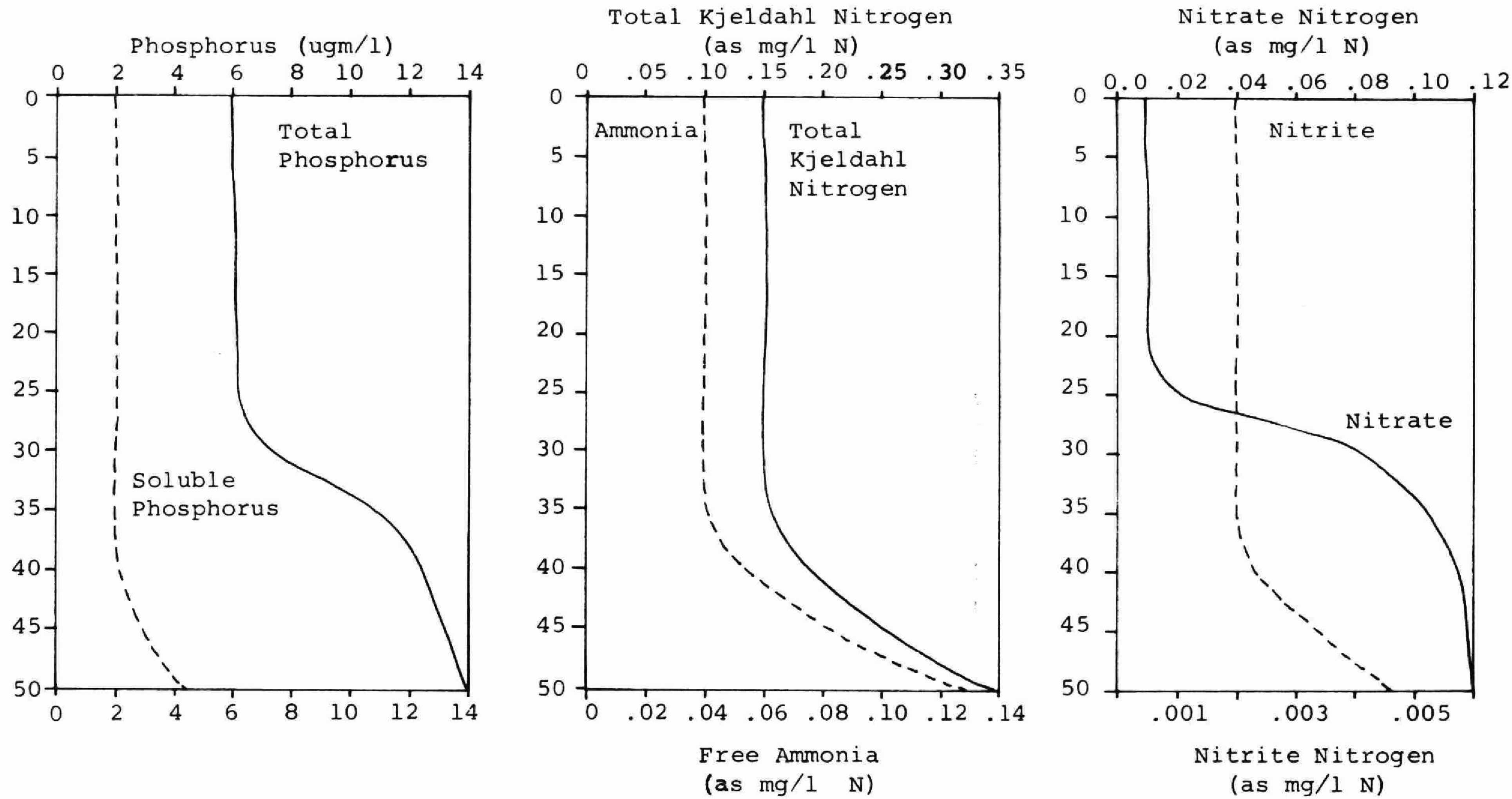

Figure 4. Profiles of total and soluble phosphorus (as P), free ammonia, total Kjeldahl, nitrate and nitrite nitrogen (as N) at Station 1 in Walker's Lake, on August 17, 1971.

(as Fe) increased from 0.02 and 0.03 mg/l at 1 and 10 feet to 0.05 mg/l at 18, 23, 26, 30 and 37 feet to 0.25 mg/l at 47 feet (Figure 5). Additionally, increases in orthosilicate values were apparent in the hypolimnetic waters of Station 1 (Figure 5).

Chlorophyll

An indication of the chlorophyll content in the lake is provided in Figure 6. Generally, low values ranging between 1.5 ugm/l at 47 feet and 3.5 ugm/l at 23 feet were encountered in Walker's Lake.

Phytoplankton populations

Figure 6 depicts the vertical distribution of phytoplankton at Station 1 in Walker's Lake. Generally, standing stocks can be considered as low to moderate ranging between a low of 325 a.s.u. per ml at 30 feet to a high of 780 a.s.u. per ml at 18 feet. Quantitatively, no definite pattern in the vertical distribution of standing stocks was apparent although definite changes in dominating species were evident with depth. For example, in the epilimnion the dominant alga was the blue-green form Aphanothece. In the thermocline this alga was replaced in dominancy by the flagellate Dinobryon and below the thermocline the flagellate Synura was the most important alga. A detailed qualitative and quantitative summary of the phytoplankton in Walker's Lake on August 17, 1971 is provided in Appendix A.

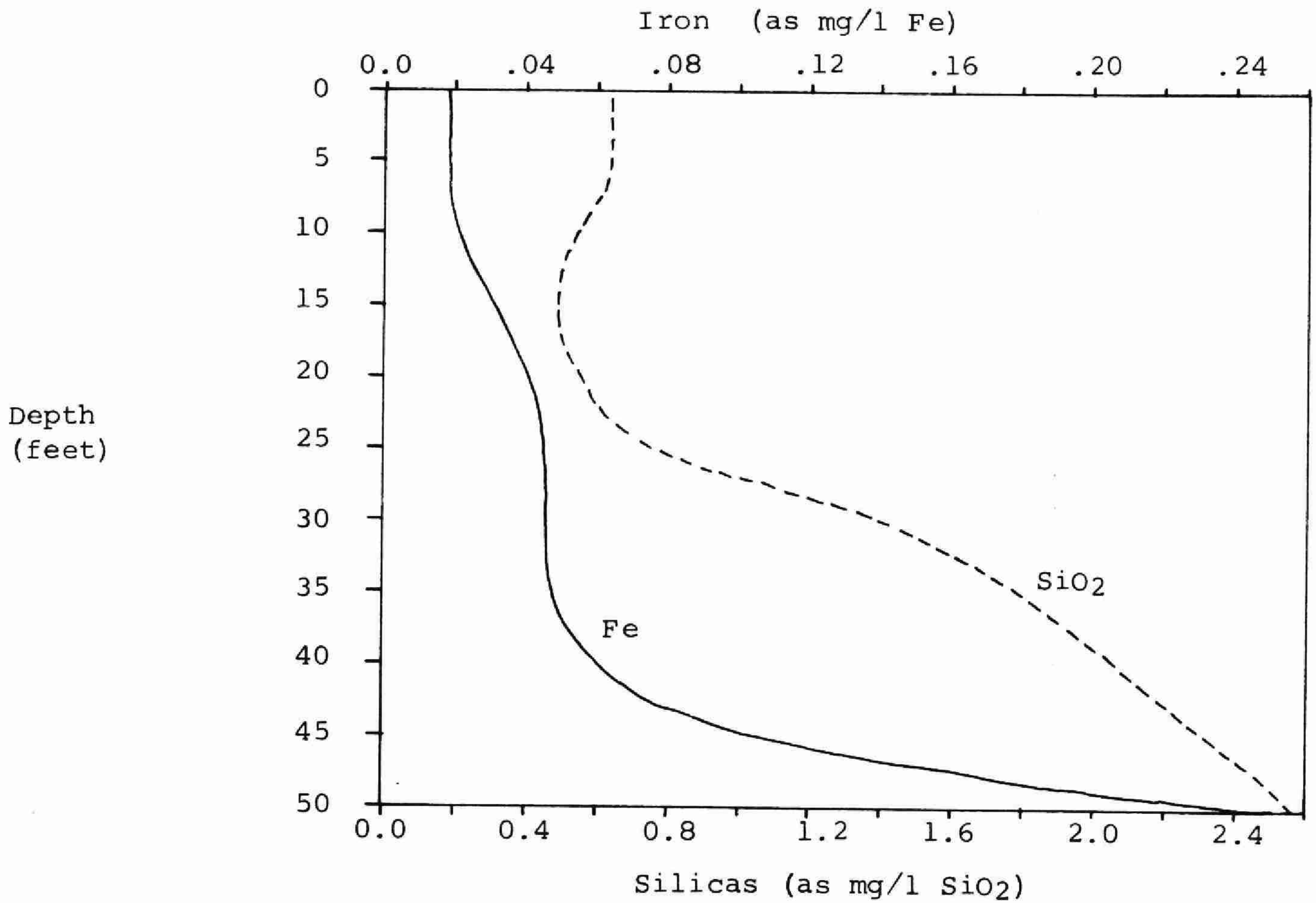

Figure 5. Profiles of iron (as **Fe**) and silica (as SiO_2) at Station 1 in Walker's Lake on August 17, 1971

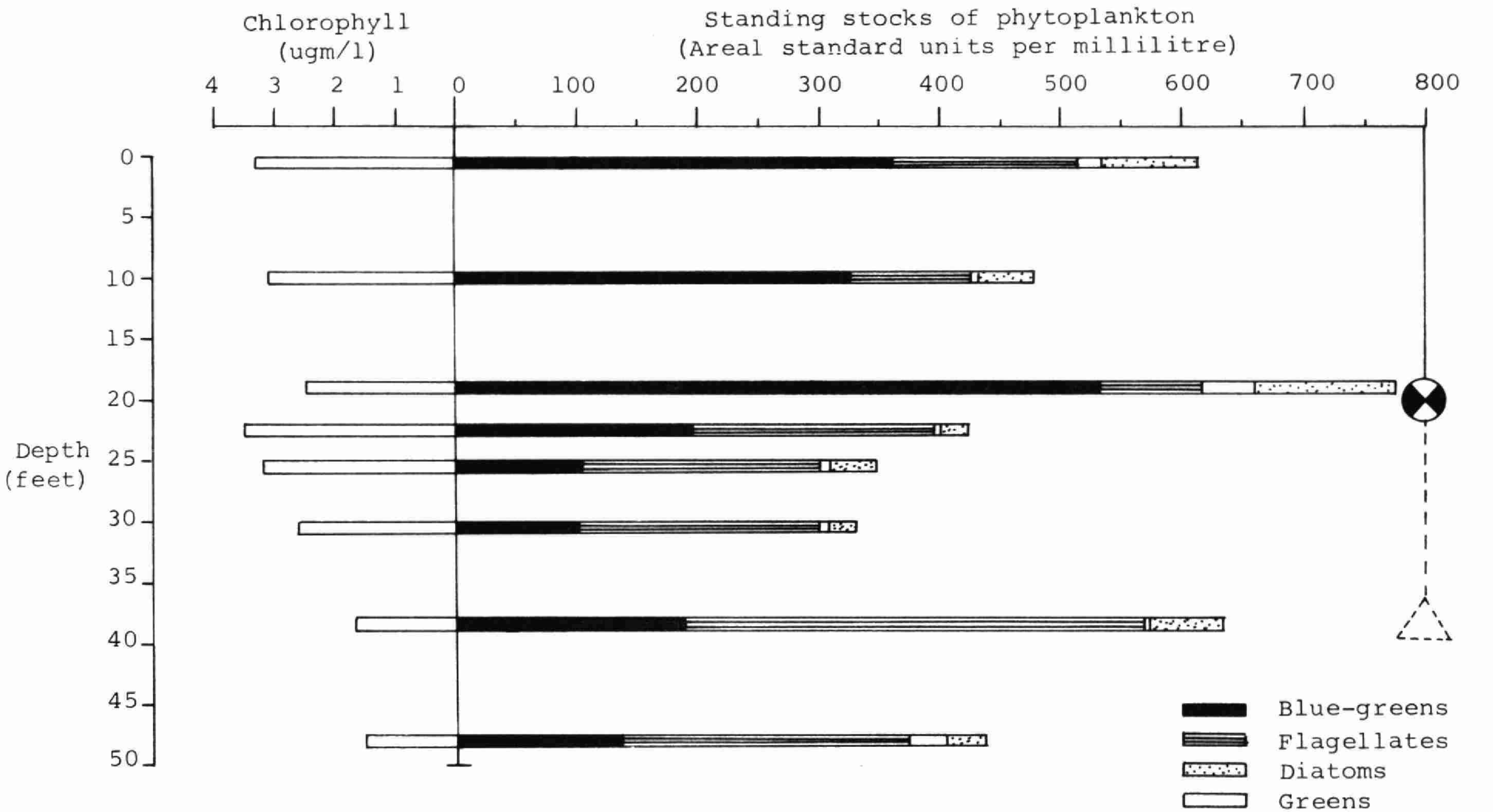

Figure 6. Chlorophyll (ugm/l) and standing stock of phytoplankton (areal standard units per millilitre) at Station 1 in Walker's Lake, August 17, 1971. Secchi disc and theoretical euphotic zone are indicated.

DISCUSSION

Status of enrichment of Walker's Lake

Secchi disc values are governed by the quantity of particulate suspended material (i.e. microscopic plants or phytoplankton, zooplankton, silt, etc), and coloured matter (i.e. humus, tannins, etc) in the water. Readings approximating 20 feet in Walker's Lake were higher than average values for Riley Lake (5.2 feet), Gravenhurst Bay (3.0 feet) and Little Lake Panache (10.1), three artificially enriched Pre-Cambrian Shield Lakes, yet slightly less than mean readings for oligotrophic Lakes Joseph (25.4 feet) and Panache (23.6 feet). The primary factor contributing to differencesin light penetration between these lakes undoubtedly is related to differences in phytoplankton abundance. On the basis of Secchi disc readings Walker's Lake can be classified as "early mesotrophic".

During summer stagnation periods, the vertical distribution of free CO_2, including bicarbonate is generally the inverse of oxygen distribution. Soft-water lakes characterized by critical oxygen depletions in the hypolimnion are characterized by increases of both analytical free CO_2 and bicarbonate (expressed as alkalinity in this study). Such CO_2 and bicarbonate increases were apparent in the hypolimnion of Walker's Lake (Figure 3). The high CO_2 values in the deeper strata can be related to conditions of decomposition while additional bicarbonate consists "...partly of ammonium bicarbonate produced in the mud by bacteria, partly of ferrous and manganous bicarbonate, of which the

cations are liberated by reduction in the mud, and partly by calcium and magnesium bicarbonate" (Hutchinson 1967). The negative heterograde CO_2 curve as well as the rise in pH in the metalimnion (Figure 3) are characteristically associated with lakes having positive heterograde oxygen distribution curves. The alkalinity, pH and free CO_2 values in the bottom waters of Walker's Lake indicate reducing conditions which in turn reflect a critical nutrient re-cycling potential.

The positive heterograde oxygen distribution or metalimnetic maximum in Walker's Lake resulted from optimum photosynthesis in the mid-thermocline region. This particular type of distribution is similar to that reported from a number of small lakes in Indiana (Eberly 1959, 1963, 1964; Wetzel 1966), Austria (Findenegg 1963, 1964), Minnesota (Baker et al. - 1969) and Ontario (Michalski and Robinson 1969; Michalski 1970 and Schindler 1971). Eberly (1959, 1963 and 1964), Wetzel (1966), Findenegg (1963 and 1964) and Baker et al. - (1969) indicated such dissolved oxygen distribution curves are characteristic of mesotrophic lakes. Based on the oxygen regime, it is logical to assume that Walker's Lake is characteristically mesotrophic.

The increase of total and soluble phosphorus, total Kjeldahl, free ammonia, nitrate and nitrite nitrogen, silica and iron in the deeper portion of the hypolimnion indicate that reducing conditions prevail in Walker's Lake. Brydges (1970) stressed that the decomposition and release of an iron-phosphorus complex from the lake sediments under reducing conditions is a major factor in controlling phosphorus

concentrations in lake water. The accumulated nutrients below the thermocline are prevented from re-entering epilimnetic waters and the trophogenic zone as long as thermal stratification persists, although algae in the upper hypolimnion of Walker's Lake may utilize solubilized nutrients originating from either decomposition of organic material formed during 1971 or from previous years' sedimented organic material. The aforementioned confirms that a critical nutrient re-cycling mechanism is currently established in the bottom waters of Walker's Lake.

The 2.0 ug/l level of chlorophyll is the analytical lower limit of the test. Results less than 2.0 ug/l are insignificant. Values between 2.0 and 5.0 ugm/l are low and indicate low to moderate algae populations. The 5.0 to 10.0 ugm/l concentrations, although moderately high, can with some reservations, be considered acceptable for most water oriented recreational activities. Levels greater than 10 ugm/l indicate troublesome levels of algae. As indicated in Figure 6, chlorophyll concentrations for Walker's Lake were slightly in excess of the analytical lower limit and correspondingly reflect the low productive capacity of the lake.

Generally, phytoplankton levels in Walker's Lake were low to moderate. The most abundant phytoplankters which developed in the lake were represented by numerous species of blue-green algae including Aphanizomenon, Chroococcus, Gomphosphaeria, Dactylococcopsis and Merismopedia and the flagellates Synura, Dinobryon, Mallomonas, Cryptomonas and Chlamydomonas. The presence of many similar species

have been reported from Dunlop Lake (Johnson et al. 1970), Bernard Lake (Michalski and Robinson 1969), Clear Lake (Schindler and Nighswander 1970) - lakes which are either oligotrophic or exhibit signs of early mesotrophy. Optimum development for Aphanothece, Dinobryon, and Synura in the epilimnion, thermocline and hypolimnion, respectively, may be related to specific separate preferences for temperature, light intensities, nutrient concentrations or a combination of these factors.

Phosphorus, septic tanks and induced eutrophication

Over the past few years investigations on a number of recreational lakes in Pre-Cambrian country have indicated that lakes are ageing at accelerated rates. Cottagers have complained of reduced water clarity; growths of algae on rocks, docks, boats or boathouses; the development of extensive weed beds; and the disappearance of deep-water species of game fish. A questionnaire circulated to cottagers throughout Lakes Muskoka, Joseph and Rosseau revealed that some 70% of those who have frequented the area in excess of 15 years detect signs of deteriorating water quality. (Michalski and Robinson 1971). Usually smaller lakes are the first to develop symptoms of accelerating enrichment. These facts have provided strong circumstantial evidence that inputs associated with cottage wastes are responsible for increasing problems of eutrophication. No one at present really understands how effective presently accepted waste treatment practises are in preventing the trans-location of nutrients to the water, particularly under shallow, coarse textured soil conditions which prevail over so much of Ontario's

cottage country. This is of supreme importance because the effects of nutrient enrichment are extremely disruptive to lake ecology and are more irreversible than any other type of pollution.

Two considerations will be examined in detail to show the complexities involved in proving that "pollution" from cottage wastes is undermining water quality.

(1) Phosphorus leachate and septic tanks.

In recent years evidence is slowly appearing relative to the effectiveness of phosphorus removal by septic systems. It is generally accepted that phosphorus is the single element which limits algal production in a lake (I.J.C. 1969) and that artificial inputs create problems of accelerating eutrophy. Hall (1970) determined that the phosphorus fixation capacity of three Maine soil types (Adams, Plaisted and Paxton) would be exceeded if these soil types were utilized as tile beds. The author stressed "....extreme care should be used on locating septic tank-drainfield waste water disposal systems adjacent to lakes or other surface waters that may be subjected to cultural eutrophication." Also, Hall (1970) confirmed that soils which allow for "....the rapid passage of water through them are not as effective in removing phosphorus as those which present more of an obstruction to the passage of water.... the better the septic tank-drainfield system operates as a wastewater disposal system, the poorer it operates as a means of protecting lake or ground waters

from polluting elements." Finally, Hall (1970) indicated that for the Adams soil, freezing and thawing (i.e. following the spring freshet) are instrumental in leaching phosphorus initially retained by the soil "....from the drainfield areas and its transport to other areas such as the lake itself." Bennett (1970) states, "One of the drawbacks to locating housing developments around lakes is that such developments often are not connected with sewage-disposal systems; rather each house is supplied with its own septic tank and tile field. If the house is close enough to the lake to benefit aesthetically from it, the field must, of necessity be laid in land sloping toward the lake. Eventually, effluents from these tile fields enter the lake and, because they carry phosphates and nitrates, they act as fertilizers, which stimulate aquatic vegetation and create nuisance problems. Prospective home owners who contemplate the purchase of lots for permanent homes on small lakes should insist on a sewage system which will carry all effluents away from the lake." Finally, the Water Sub-Committee of the Natural Resources Committee of State Agencies for the State of Wisconsin in a report dated January 31, 1967 estimated that the phosphorus contribution reaching natural water courses from septic tank-tile field beds was 0.2 lbs/capita/year.

With specific reference to Walker's Lake, Bird and Hale (1971) state that the bedrock is characterized by fractures which may "....conduct tile bed effluent

directly to the groundwater or lakeshore" and comment on the seriousness of the problem "....if adequate retention in the soil takes place, or during heavy rainstorms or spring runoff when virtually no retention occurs." Additionally, the authors point out that "Walker's Lake is susceptible to accelerated eutrophication under the stress of excessive or improperly controlled development." In light of the aforementioned, Bird and Hale (1971) recommend that large quantities of fill be imported to improve the suitability of cottage lots.

The absence of adequate guidelines which take cognizance of various on-site features such as soil depth, soil type (including chemistry), permeability, slope, presence of vegetative cover, distance to water, depth to water table and the adsorption and retention capacity of the terrain is well recognized. Since present regulations do not take all of these complex factors into consideration, it is unlikely that by simply importing fill the water quality of Walker's Lake will be maintained at its current level.

(2) Phosphorus loadings in recreational lakes.

On the basis of annual phosphorus waste loadings per se, it would appear that inputs from cottages to recreational lakes are not great enough to cause problems. For example, maximum phosphorus loadings into Little Lake Panache and Riley Lake have been calculated as 0.8 and 0.12 $gm/m^2/year$, respectively (Brydges, in press). On the basis of Vollenweider's (1969) eutrophication model,

Little Lake Panache would be oligotrophic while Riley Lake would be mesotrophic. However, accelerated eutrophy has been demonstrated in both lakes by extensive blue-green algae blooms and phytoplankton counts in excess of 5,000 a.s.u. per ml during the summer and fall months (Michalski 1969 and, Michalski and Robinson 1970). By comparison, Michalski (1969) indicated that standing stocks of algae at the Union Water Treatment Plant located along the northern shoreline of the Western Basin of Lake Erie averaged 5,150 a.s.u. per ml in 1967. Since the Western Basin of Lake Erie is characterized by phosphorus loadings 87 and 58 times greater than either Little Lake Panache on Riley Lake (I.J.C. Report Vol 2), it is apparent that recreational lakes are being affected by diffuse inputs which ordinarily would be too low to be a problem.

Brydges (in press) utilizes information from twelve lakes, all of which thermally stratify, exhibit clinograde oxygen curves and develop effective nutrient re-cycling mechanisms. The author demonstrates that apparent insignificant yearly inputs of phosphorus from septic tank-tile field beds and/or other cottage waste disposal systems are incorporated into the lake's iron-phosphorus re-cycling mechanism. In time, the influx "magnifies" to problem developing conditions. It follows therefore that in a developed lake, the amount of phosphorus re-cycling relative to the amount of iron would be expected to be greater than in an undeveloped lake. Iron-phosphorus ratios in artificially enriched

Little Lake Panache and Riley Lake were 7.0 and 9.0 respectively, while those of Buchanan and Millichamps Lakes, two "unpolluted" lakes near Dorset were 33 and 71, respectively (Brydges, in press). A relatively low iron-phosphorus ratio of 18 indicates a critical reducing potential for Walker's Lake and that any apparent insignificant additions of phosphorus would eventually undermine water quality. Of some significance is that Brydge's "magnification concept" would account for the lag between large scale development of a lake and the onset of eutrophication symptoms.

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APPENDIX A

Algae counts completed on samples collected from seven depths at Station 1, Walker's Lake, August 17, 1971. All results are expressed as areal standard units per millilitre.

Algal Type / Depth (feet)	Surface	10	18	23	26	37	47
Blue-greens							
Anabaena		4	2				
Aphanothece	313	304	486	173	106	160	134
Chroococcus	10	2	14	6		16	1
Dactylococcopsis	10		19			2	
Gomphosphaeria	23	9	8	9		2	3
Lyngbya		2	1	4	1		
Merismopedia	8	4	4	4	2	1	
Sub-total	364	325	534	196	109	181	138
Flagellates							
Ceratium	35						
Chlamydomonas	23	26	20	25	22	36	11
Chrysophaerella		3					
Cryptomonas	36	16	23	38	38	67	28
Dinobryon	31	22	38	111	92		
Gonium		3					
Gymnodinium				9			
Mallomonas	7	2	3	5	8	18	33
Ochromonas	16	16	3	6	5	7	1
Peridinium	2		8		8	7	
Synura	3	12	2	4	23	240	163
Sub-total	153	100	97	198	196	375	236

Appendix A - Cont'd.....

Algal Type \ Depth (feet)	Surface	10	18	23	26	37	47
Greens							
Botryococcus			14				27
Cosmarium						4	
Crucigenia			1			2	1
Euastrum			8				
Mougeotia		7					
Oocystis	1		3	3	3		1
Pediastrum							1
Quadrigula					5		
Scenedesmus	2		2			1	
Selenastrum					4		
Sphaerocystis	26	2	21	3	1		1
Sub-total	29	9	48	6	13	7	31
Diatoms							
Achnanthes	1						
Asterionella	4		3		16	16	8
Cyclotella	2	6		5	3	2	
Melosira			4				
Navicula	1						
Nitzschia	1					4	1
Rhizosolenia	2	1	4	6			
Synedra			1				
Tabellaria	62	38	87	19	8	46	22
Sub-total	72	45	101	25	27	68	31
TOTAL	618	479	780	425	345	631	436

STATUS of Enrichment - WALKERS LAKE